Municipal Experience with "Pay As You Throw" Policies: Findings From a National Survey

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Abstract

Municipal Experience with "Pay-As-You-Throw" Policies: Findings From a National Survey

Based on a large, nationally representative sample of cities with recycling programs, this study examines whether a Pay-As-You-Throw (PAYT) pricing policy for solid waste collection and disposal service is an incentive for households to change their waste disposal and recycling behaviors. The study finds that cities that adopted this policy realized significant reductions in the amount of waste disposed per household and significant increases in the amount of materials recycled, controlling for the effects of other policies and demographic features. The study concludes that a PAYT policy has potential to help local officials advance the strategic waste management goals of waste reduction, increased recycling, and control of waste disposal costs.

Municipal Experience with "Pay As You Throw" Policies: Findings From a National Survey

Pay as you throw (PAYT), also known as variable rate or unit based pricing charges customers based on the amount of solid waste they discard. This strategy for pricing local solid waste collection and disposal services is analogous to that used by local utilities for electricity, gas, water, and sanitary sewer services where customers pay for what they use, except in this case, citizens pay for how much they throw away. Once limited to a few hundred cities 20 years ago, there now are 4,032 communities in 43 states with PAYT programs (U.S. EPA 2000). Collectively, these communities serve about 10% of the U.S. population or about 27 million residents (Burgiel and Randall 1998).

What prompted local officials in these communities to tackle the political challenges of persuading citizens to pay for solid waste collection and disposal based on the volume of waste discarded? Why adopt this method of financing and abandon reliance on local taxes as the primary funding mechanism, especially when many citizens might conclude that they must now pay for this formerly "free" service? Similarly, are the merits of a variable fee system sufficient to overcome the simplicity of a flat fee policy that charges all households the same amount regardless of how much waste they place at the curb? What have communities with PAYT policies learned that might benefit other local officials considering adoption of this policy?

There are several purported benefits of PAYT policies. Among the more prominent advantages described in the literature are the potential to: reduce solid waste collection and disposal costs for the community, reduce the volume of waste generated by households, and increase the levels of solid waste recycling and composting (Kutzmark and Canterbury 1996, Canterbury 1998, Horton 1999, Bauer and Miranda 1996). Claims of savings in collection and disposal costs are predicated primarily on less municipal solid waste (MSW) disposed by

households. If residents set out less MSW at the curb, there is the possibility that a city could extend collection routes, reduce the size of truck fleets, and cut back on the number of collection crews or crew sizes (Canterbury 1998). If less waste is landfilled, there also may be savings in tipping fees, transportation, and transfer costs. Landfill life also might be extended. What would induce a household to generate or throw away less waste (source reduction) hinges on at least two elements: the incentive built into the unit pricing structure for solid waste collection and disposal, and the availability of convenient (and legal) alternatives to disposal such as recycling and yard waste collection or composting programs.

Theory

O'Leary et al. (1999, 6) observe that "if the goal is to wed waste reduction and efficiency, a system of volume-based garbage pricing would be more logical than a flat fee system." The theory implicit in a market incentive such as quantity-based fees for waste disposal is that households are required to internalize the full costs of their consumption and waste disposal practices. By contrast, the largely "invisible" costs paid through local tax levies or flat fees may lead people to generate inefficiently high levels of MSW because they face a zero price increment for using more collection service. In other words, if households face a marginal or incremental cost of refuse disposal equal to zero, they may dispose of greater than optimal quantities of waste. (Jenkins 1993). Theoretically, households that desire to minimize waste disposal costs in a PAYT pricing regime may reduce the amount of waste generated, dump its trash unlawfully, or if such programs are available, participate in local recycling and yard waste collection programs.

Households also may reduce the amount of waste disposed by reusing certain items or by changing purchasing behavior. For example, they might buy fewer discretionary items, select

products that have less packaging, or purchase more products that have recyclable packaging (Ebreo, Hershey, and Vining 1999). Households also may recycle more of the materials that are included in local collection programs. Any increase in recycling presumes, of course, that this option is available and that residents find it to be more convenient than disposing of trash through various illegal or undesirable means (Fullerton and Kinnaman 1996).

In a larger context, volume-based fees for solid waste services are just one example of the promising use of economic incentives and market-based environmental policy instruments to encourage behaviors that advance both individual interests and collective policy goals.

Governments have devised a number of tools to harness market forces to achieve environmental objectives. These include recycling investment tax credits, deposit-refund programs for beverage containers and lead-acid batteries, transfer of development rights in connection with wetlands protection, pollution charges, emissions trading, dedicated lanes for car/van pooling, subsidy elimination, and a variety of fees, charges, or tax credits to encourage environmentally friendly behaviors (Stavins 2000). While the idea of using economic incentives to internalize environmental and other externalities is neither new nor necessarily appropriate for every environmental problem, there is growing recognition that they have the potential to promote more cost-effective and technologically innovative solutions than traditional command and control approaches (Stavins 2000).

Research Purpose

The purpose of this research is to investigate the impact of PAYT policies on household waste disposal and recycling behaviors, the two behaviors that must change for a variable fee pricing system to have some effect on controlling or reducing solid waste collection and disposal costs for a community. These are the primary dependent indicators in this study. We examine

the impact of PAYT policies among the population of U.S. cities that offer a reasonably convenient and legal alternative to disposal, namely solid waste recycling.

The rationale for this approach is to avoid attributing any observed reduction in waste generation to a PAYT policy if households are, in fact, dumping their waste illegally or in some undesirable way such as in commercial dumpsters to avoid paying higher disposal fees. We assume that *most* households will find it more convenient to take recyclable materials to the curb, for instance, than to load one's vehicle routinely with malodorous garbage to dispose of it somewhere else. Some unlawful or undesirable waste disposal still may occur among cities with recycling programs, but at least households in these communities all have a comparable, legal alternative to minimize their waste disposal costs.²

We measure household waste disposal behavior as the mean tons of solid waste disposed per household per year in a community. We measure recycling behavior by two indicators: (1) the mean tons of recyclable materials collected per household annually, and (2) the mean citywide recycling diversion rate that represents the percentage of the total MSW stream diverted from disposal by local recycling (excluding any diversion of yard trimmings). Our unit of analysis is the municipality. We compare outcomes on these measures among cities with recycling programs for those jurisdictions with and without a PAYT pricing policy. We then seek to control for the effects of factors other than a PAYT policy, suggested by theory and previous research, that might affect our dependent variables.

Our aim is to specify the impact of a PAYT policy and to identify any circumstances that condition the impact of this pricing policy on waste disposal and recycling behaviors in communities. One limitation of our data is that we do not have specific information on the magnitude or range of fees or prices charged in cities with PAYT policies. However, we think

local officials in the majority of U.S. cities that do not have a PAYT policy would benefit by knowing what, if any, reduction in waste disposal or increase in recycling occurred among cities that adopted a PAYT policy. Quantifying the impacts of a PAYT policy with respect to these two outcomes can help local officials to determine whether promoting this policy is worth engaging the political challenges associated with changing the way solid waste collection and disposal services are financed.

Previous Research on PAYT

The signal feature of the scholarly work on the impact of PAYT policies is its lack of consensus. Bauer and Miranda's (1996) conclusion in their review of this literature still holds today. They observed that:

"Experts disagree about the effect of variable collection fees on household waste disposal behavior, as well as the seriousness of possible side-effects...skepticism remains regarding whether variable rates can be successful everywhere, of if they are suitable only for certain types of communities."

We think one of the primary reasons for skepticism about the impact of PAYT policies on household waste reduction and recycling behavior is that most research studies examined only a single jurisdiction or a very small number of communities. While well-designed case studies can illuminate many of the potential positive and negative effects of PAYT, it is not surprising that they offer less than conclusive evidence for generalizations about the effects of this policy on waste reduction and recycling behavior.

For example, Reschovsky & Stone (1994) surveyed households in one New York County to determine whether pricing waste disposal services based on the waste generated encouraged household recycling. They found that the county's trash tag system did not significantly affect reported recycling in isolation of either mandatory recycling or curbside pick-up. In other words, once the authors controlled for the effects of these two other policies, PAYT pricing using trash-

tags did not significantly increase recycling behavior. However, they did find that the county's unit pricing system had a significant positive effect on participation in the county's composting program. They concluded that since yard waste comprises about one-fifth of MSW, by weight, an incentive to participate in composting yard and food wastes is likely to generate substantial savings for a locality.

Miranda, Everett, Blume, and Roy (1994) examined 21 smaller cities with unit pricing that the authors admit are not nationally representative. They found that mean waste generation decreased by 30%, the amount of tons landfilled decreased by an average of 40%, and the mean number of tons recycled increased by 126% after these communities adopted unit-pricing programs. They also found that cities with a completely variable fee structure (where the fixed costs of collection are incorporated into the variable rate) have a higher average level of reduction in waste landfilled compared to the two cities that had a multi-tier fee structure.³ The authors noted that they could not control for the effects of other policies or demographic factors on waste generation or recycling behavior because of their small sample size.

Bauer and Miranda (1996) studied 13 larger U.S. cities with unit pricing and found that this policy encouraged greater waste diversion (through recycling), but not necessarily greater waste reduction. While twelve of the cities in their study experienced recycling rates higher than the national average, they found little evidence to suggest that unit pricing resulted in source reduction behavior.

Fullerton and Kinnaman (1996) studied the responses to pricing garbage by the bag or container among 75 households in Charlottesville, VA. The city operated a voluntary curbside recycling program and required residents to purchase an \$.0.80 sticker to affix to each unit of garbage (approximately 32 gallons) set out for collection. Containers without stickers were not

collected. The authors counted and weighed bags or cans of garbage and recyclables and found evidence to suggest that people generated somewhat less garbage, by weight, and recycled more after the sticker system was adopted. They also found that waste reduction was greater among households with higher incomes and that married residents were more likely to overstuff garbage receptacles to minimize disposal costs. Only a few residents disposed of waste illegally. They estimated that waste was reduced by 10% and that recycling increased by 16%. They concluded that the overall incremental benefit of unit pricing was small.

Other case studies that vary considerably in methodological quality have reported various degrees of success in waste reduction and recycling. The U.S. EPA has compiled a fairly extensive on-line literature review of PAYT studies and stories.⁴ For example, the on-line EPA publication entitled "PAY-As-You-Throw Success Stories" offers testimonials from MSW officials in nine cities that experienced waste reduction outcomes that ranged from 35% to 71% after switching to a PAYT policy.

A national survey of cities with PAYT polices was conducted by Skumatz (1996). Her consulting firm surveyed approximately 500 city officials by telephone that included an oversampling of cities with unit pricing. This report suggested that variable rates helped to increase recycling by an average of eight to 11 percentage points. This study also found that diversion rates were higher among cities with smaller populations, higher median incomes, and among those that offered curbside recycling. They concluded that variable rates were the single most important factor in contributing to higher levels of recycling. In a subsequent, Skumatz (2000) estimated that between 5 to 7 percent of municipal waste reduction was attributable to having a variable rate policy after accounting for the impacts of recycling and yard waste programs.

In a methodologically rigorous analysis, Kinnamman and Fullerton (2000) examined the impact of user fees on waste generation and recycling for 114 cities with PAYT policies using data from 1991. They also collected waste and recycling data for an additional 845 cities, none of which had PAYT policies but some of which offered curbside recycling. They developed models that controlled for a variety of program variables and demographic features and also accounted for the possible endogeneity of local policy decisions with respect to adoption of a PAYT policy, the size of the fee, and whether to offer curbside recycling. In other words, they sought to determine whether PAYT and curbside recycling policies were adopted by cities whose citizens were more environmentally aware or receptive to "green" policies, in which case the policy impact would be overstated, or whether the likelihood of adopting these policies was a positive function of the volume of waste generated in the community, a relationship that could understate the effects of PAYT policies. They found support for the later effect in their study and estimated that implementation of a PAYT policy (changing the price from zero to one dollar) reduced waste generation by 412 pounds per person per year and increased the quantity of materials recycled by 30 pounds per person per year.

These previous studies of PAYT vary in quality, the units of analysis employed, and the number of cases examined. On balance, they suggest that PAYT might have some positive impact on waste reduction and perhaps a somewhat greater impact on household recycling. The magnitude of and conditions under which these effects occur remain unclear. We endeavor to specify these effects and conditions by analyzing the results obtained from a large, representative national sample of cities with recycling programs.

The Data

The data for this study are derived from a 1997 national mail survey of municipal solid waste managers and recycling coordinators. A total of 5,044 cities were identified as operating a solid waste recycling program during 1996. From this population, a sample of 2,096 cities was selected in such a way as to obtain a random sample for the states stratified by population size. The population strata used for these state samples used cut-points of under 10,000 population, between 10,000 and 100,000, and above 100,000 population. The recycling coordinators in these 2,096 cities from 44 states represented 41.6% of *all* cities with recycling programs. The initial mailing in spring 1997 and three follow-up contacts yielded responses from 1,025 recycling coordinators for a return rate of almost 50% (48.90%). These responses represented over 20% of all cities in the US with recycling programs.

Among the responding cities, 794 (or 78.5%) offered curbside collection of recyclables and 218 (21.5%) had only drop-off recycling programs. About one-fourth (250) of responding cities had some type of PAYT policy. Among the 755 cities with curbside collection for which we have responses, about one-fourth or 188 cities had PAYT pricing for solid waste collection. The remaining 62 cities with a PAYT policy had only a drop-off recycling program.

Types of PAYT Policies

There are three main ways cities may implement a variable fee policy. Customers may be required to purchase for a certain price approved bags, tags or stickers that residents use or affix to the containers set out at the curb. The advantage of this strategy is that it eliminates the need for a billing system. Cities also may use unit pricing for different levels of subscription service. Customers subscribe to a waste collection service level that varies in price based on the number or size of cans/containers used. Finally, collection crews may actually weigh the solid waste disposed at the curb and charge customers based on these data.

We obtained data on the type of policy used by several cities in our study from state solid waste management contacts, city web sites, and data collected by Miranda (1996). For 109 cities we determined that 57% used cans, 41% used bags, tags, or stickers, and 2% weighed solid waste at the curb. For 93 cities in our study, we ascertained that two-thirds (65.6%) had a fully-variable fee structure and that the remaining cities used a multi-tier pricing system or an additional base tax. With fully variable pricing, households pay for each can or bag set out; fixed costs are incorporated into the variable rate based on estimated average costs. In a multi-tier system, a flat fee incorporates the fixed costs for a basic level of service and residents pay variable fees for incremental service above the basic level. An additional base tax system levies a flat fee to cover fixed costs of collection, but instead of receiving a basic level of service a variable rate applies to the number or size of containers set out.

Municipal Features and Adoption of a PAYT Policy

Previous research suggests that several features, policies, or characteristics might distinguish cities that adopt PAYT (Kinnaman and Fullterton 2000, Feicock 1996, Folz 1991, 1999, Skumatz 1996). As Kinnaman and Fullterton (2000) observed, treating PAYT as exogenous, or independent of other features or characteristics, might lead to biased estimates of its effect, in either direction, if particular variables that covary with it are ignored. The policy's effect might be overstated, for example, if the estimation process omits an important characteristic of the population such as its environmental awareness or receptivity to "green" programs. Likewise, various characteristics of the population might account for their receptivity to a PAYT policy. A city also may be more likely to adopt a PAYT policy if the magnitude of their solid waste disposal problem is larger and they confront a landfill space shortage.

We use logistic regression to determine whether cities with particular characteristics, policies and features are more likely to adopt a PAYT policy. We estimate whether the adoption of PAYT (a dichotomous "no, yes" dependent variable) is explained by community characteristics that include form of government (reformed or unreformed), population size, the percentage white population, the percent of the population with at least some college, mean household income, the years of useful life that remain in the landfill used by the city, and the total tons of waste disposed in 1996. We also include dichotomous measures of other policies such as curbside recycling and mandatory recycling participation. As a surrogate measure of the community's receptivity to "green" practices, we include a dichotomous rating of the recycling coordinators' rating of citizens' current level of support for the city's recycling program (0 = very weak, weak, or moderate and 1 = strong or very strong). The test is whether any of these variables remain significant when incorporated in the model and help to predict PAYT adoption.

Table 1 shows that the model correctly predicts 75.6% of PAYT adoption decisions and has a statistically significant chi square that indicates a statistically acceptable model. However,

Table 1 goes here

the pseudo R² statistics indicate a small "explained variance" or more accurately, a very weak association. Only one demographic feature, percent of the population with at least some college, attains statistical significance in the model. This means that for a one percent increase in the proportion of the population with at least some college education, the odds of a city adopting a PAYT policy increase by about 3.5%. With this exception, none of the variables in the model predict that a city will adopt a PAYT policy. The implication is that there is little risk of producing biased estimates of the effect of PAYT if this variable is treated as exogenous since its

adoption does not appear to be predicted by the volume of solid waste generated, the level of citizen support for recycling, or most other policy and demographic features.

The Impact of PAYT on Household Waste Disposal Behavior

We employed Ordinary Least Squares (OLS) regression to test the proposition that PAYT has an independent effect on reducing waste disposal and increasing recycling. In the first model, we hypothesized that cities with a PAYT policy will have a lower mean level of solid waste disposed per household annually. The impact of a pay as you throw policy on waste disposal behavior was measured controlling for the possible effects of other variables identified in the literature review and our previous analyses. Table 2 shows the independent effects of the PAYT policy as well as the other policy and demographic features.

Table 2 goes here

Three factors have a statistically significant independent effect on the amount of waste disposed per household. PAYT is one of these. Adopting PAYT results in a mean reduction of 1.16 tons disposed per household per year controlling for the effects of all of the other factors in the model. This result indicates that PAYT does indeed have an independent effect, in the expected direction, on household waste disposal behavior regardless of other recycling program features or demographic characteristics that distinguish cities.

The model results also indicate that as the percentage of persons with at least some college education increases, the waste generated by households increases by .044 tons per year. Likewise, as the number of years of useful life remaining in the landfill increases by one year, waste generation increases by .024 tons.

The Impact of PAYT on the Quantity of Materials Recycled Per Household

Previous analyses suggested that PAYT might be an incentive for households to recycle larger quantities of materials. We examine the impact of PAYT controlling for the effects of other program features and community demographics. The results in Table 3 support the proposition that households in cities with PAYT recycle a statistically larger quantity of

Table 3 goes here

materials annually. On average, households recycle about .152 tons or about 300 pounds more per year in cities with a PAYT policy. Neither income, education, type of recycling participation, curbside recycling, composting program, years of landfill life remaining or level of resident support for recycling contribute any statistically significant impact. This analysis indicates that cities with a larger white population realized a small but statistically significant increase in additional recycling per household. These findings confirm that PAYT is an incentive for households to recycle larger quantities of materials.

The Impact of PAYT on the Citywide Recycling Diversion

The results from the regression of the citywide rate of recycling diversion among cities are shown in Table 4. Once again, the assertion that PAYT helps to boost recycling in a community is supported. Controlling for the effects of type of recycling participation, the level of residents' support for the program, and other demographic characteristics, cities with variable fees have a mean level of recycling diversion that is about 2.49 percentage points higher than in cities without PAYT. By adopting a PAYT policy, a city with the mean recycling level in this study of 26.4% could expect to see that increase to about a 29% level regardless of any other variations in recycling policies or demographics.

Table 4 goes here

Four other factors also attain statistical significance in explaining the level of recycling diversion in a community. The largest difference is observed among cities that mandate recycling participation. Recycling diversion in voluntary programs is 4.48 percentage points lower. In this model, there is also a linkage between the level of popular support for the recycling program and higher levels of achieved diversion. Strong support for recycling among residents increases diversion by 3.64 percentage points. Also, as the white proportion and educational level increases, small increases in recycling diversion levels are realized.

Conclusion

These findings from a national survey of cities with recycling programs offer modest evidence that a Pay As You Throw policy is a potentially important incentive for residents to alter their waste disposal and recycling behaviors in the ways that policy architects, environmentalists, and local officials expect. In PAYT cities, households dispose of less solid waste and set out larger quantities of recyclables irregardless of other policies or demographic features. Cities with PAYT also realize a higher overall level MSW diversion through recycling.

Based on our analyses, PAYT appears to have its strongest incentive effect among cities with voluntary curbside recycling. If mandating recycling participation is not a politically feasible policy alternative to help control waste disposal costs, then local officials may find PAYT to be the next best policy choice to increase recycling and to reduce the proportion of the waste stream that winds up in the local landfill.

If local officials can show residents that it is possible to reduce or at least control their waste collection and disposal costs with a fully variable PAYT policy, and they can demonstrate how much the local property tax rate can be reduced or how much residents might save over a flat fee (that subsidizes larger waste generators) then political opposition to a PAYT policy may

be deflected. Accomplishing that, of course, can be a significant hurdle for local officials. We think there must be some explicit *quid pro quo* communicated to citizens, otherwise they may assume that variable fees are just creative way to sneak in a new local tax. For example, when Athens-Clarke County, Georgia officials implemented their PAYT system, the local property tax rate (revenue from which formerly funded solid waste and recycling services) was not reduced, but local officials promised residents that these "extra funds" would finance several highly popular local projects (Dickerson 1999). Alternatively, the nature of the appeal may involve the intrinsic environmental value of generating less municipal waste. Seattle, for example, initially based its rates on the direct costs of collection and disposal, but later the city increased these fees above direct service costs to give households an even greater incentive to recycle and reduce the volume of wastes generated (O'Leary et al. 1999).

For local officials in the majority of U.S. cities without PAYT that are concerned about how to control increasing waste collection and disposal costs, or how to apportion these costs more fairly, this study provides evidence that a PAYT policy helps to reduce waste generation and increase recycling. The magnitude of these behavioral differences among cities appears to be large enough to merit analytic scrutiny by local officials and should prompt further investigation into other ways that environmental aims can be achieved through the use of market-based policy instruments. Clearly, a PAYT policy can help to internalize the full costs of waste generation for customers. It also enables them to have some control over how much they spend for solid waste collection. This by itself is a desirable outcome.

We think additional research is warranted concerning the elasticity of residential waste production with respect to price. This study does not answer, for instance, whether larger differences in charges for higher volumes of waste generation translate into significantly larger

changes in waste disposal behaviors. Does the price charged for stickers, tags, or bags for waste disposal have some optimal level in terms of its impact on waste reduction and recycling before more residents "rebel" and dispose of waste in illegal or undesirable ways? What impact do PAYT policies have among very low income residents or among those in multi-family structures where it is more difficult to implement a PAYT policy? All of these issues warrant additional attention by scholars, but this study provides evidence that PAYT has the potential to help advance the strategic goals of effective solid waste management.

Table 1. Logistic Regression Estimates for Adoption of a PAYT Policy

Variables	В	S.E.	Wald	Sig.	Exp(B)
Mandatory recycling	277	.850	.106	.745	.758
Curbside recycling	068	.290	.055	.814	.934
Composting yard wastes program	.088	.240	.135	.713	1.092
Mean household income	.000	.000	3.582	.058	1.000
Mean education level	.035	.010	12.429	.000	1.036
Percent white	010	.008	1.699	.192	.990
Population size	.000	.000	.261	.609	1.000
Reform government structure	194	.220	.775	.379	.824
Total tons waste disposed in 1996	.000	.000	1.882	.170	1.000
Level of citizen support for recycling	.077	.243	.101	.751	1.080
Constant	-1.177	1.241	.899	.343	.308

Percent Correct Predictions	75.6
Model Chi Square	33.184**
Cox & Snell R ²	.058
Nagelkerke R ²	.087
N =	554

^{**} p < .001.

Table 2. Regression Results for Mean Tons of Waste Disposed per Household (1996)

	Unstandard.	Standardized		
Independent	Coefficients	Coefficients		
Variables	b	Beta	t	Sig.
(Constant)	2.42		1.56	.11
PAYT	-1.16	147	-2.80	.00
Percent white	012	052	974	.33
Mean hh income	003	142	-1.88	.06
Education level	.044	.199	2.54	.01
Type participation	.664	.093	1.66	.09
Resident support for	.214	.058	.964	.33
recycling program				
Years of landfill life	.024	.132	2.51	.01
Curbside recycling	952	101	-1.78	.07

 $R^2 = .09$

Table 3. Regression Results for the Quantity of Materials Recycled per Household (1996)

	Unstandard.	Standardized		
Independent	Coefficients	Coefficients		
Variables	b	Beta	t	Sig.
(Constant)	462		-2.05	.04
PAYT	.152	.129	2.49	.01
Percent white	.003	.102	1.98	.04
Mean hh income	.0004	.112	1.52	.13
Education level	0002	001	008	.99
Type participation	.014	.013	.245	.80
Resident support for	.002	005	092	.92
recycling program				
Years of landfill life	.001	.046	.896	.37
Curbside recycling	.116	.081	1.52	.13

 $R^2 = .06$

Table 4. Regression Results for Citywide Recycling Diversion Rate (1996)

	Unstandard.	Standardized		
Independent	Coefficients	Coefficients		
Variables	b	Beta	t	Sig.
(Constant)	015		003	.998
PAYT	2.49	.071	1.96	.05
Percent white	.124	.119	3.19	.00
Mean hh income	.0001	.128	2.54	.01
Education level	009	009	177	.86
Type participation	-4.48	146	-3.77	.00
Resident support for	3.64	2.16	5.41	.00
recycling program				
Curbside recycling	2.56	.06	1.65	.09

 $R^2 = .16$

Notes

- 1. Minnesota communities now comprise about 45% of all jurisdictions with PAYT because the state mandates that local governments adopt some form of unit pricing for residential solid waste billing. This study was conducted before most Minnesota cities complied with the 1994 state mandate to implement a PAYT policy.
- 2. Miranda (1996) found that undesirable diversion among case study cities was no worse in unit pricing cities than in similar cities without variable collection rates.
- 3. In a multi-tier fee structure, the estimated fixed costs of collection and a basic level of service are financed by a flat fee or through local property taxes and then households pay variable fees for incremental service levels above the base level.
- 4. These studies can be found at the following U.S. EPA web site:

http://www.epa.gov/payt/research.htm

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